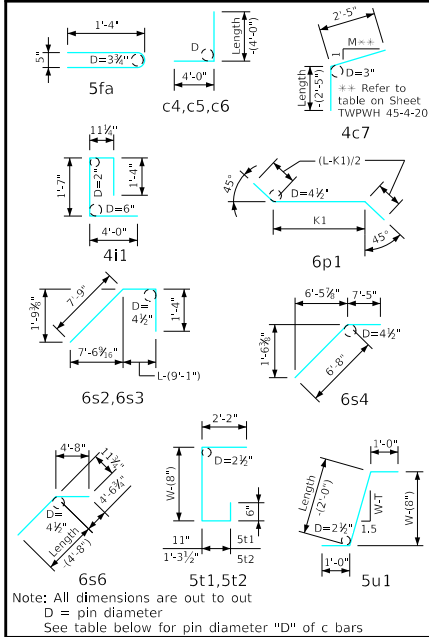


ENGLISHLRFDDESIGNEDTWINCULVERTS.DGN - TWPWH 45-7-20 51 - THIS SHEET ISSUED 07-20-2020

Bent Bar Details



c Bar Pin Diameter	
Bar Size	D
5	3 3/4"
6	4 1/2"

Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height

Location	Shape	12' x 12'				12' x 11'				12' x 10'				12' x 9'				12' x 8'				12' x 7'							
		Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.	Bar No.	No.	Length	Wt.				
Fence Anchor (Galv.)	5fa	2	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6	5fa	2	2'-10"	6				
Wingwall, F.F.H.	5b1	2	2	56'-2	122	5b1	2	51'-11	113	5b1	2	47'-8	104	5b1	2	43'-5	96	5b1	2	39'-2	82	5b1	2	34'-11	73				
Wingwall, F.F.H.	5b2	22 Var.	2	Each 11'-9 to 54'-2	776	5b2	20 Var.	2	Each 11'-9 to 49'-11	658	5b2	18 Var.	2	Each 11'-9 to 45'-9	550	5b2	16 Var.	2	Each 11'-9 to 41'-6	449	5b2	14 Var.	2	Each 11'-9 to 37'-3	358				
Wingwall, B.F.H.	4b3	2	2	56'-9	79	4b3	2	52'-6	73	4b3	2	48'-1	67	4b3	2	43'-10	62	4b3	2	39'-7	53	4b3	2	35'-3	47				
Wingwall, B.F.H.	4b4	20 Var.	2	Each 16'-7 to 54'-9	489	4b4	18 Var.	2	Each 16'-7 to 50'-6	413	4b4	16 Var.	2	Each 16'-5 to 46'-1	340	4b4	14 Var.	2	Each 16'-5 to 41'-10	276	4b4	12 Var.	2	Each 16'-4 to 33'-3	216				
Interior Wall, Both F.H.	5b5	21 Var.	2	Each 8'-9 to 55'-5	720	5b5	19 Var.	2	Each 8'-9 to 51'-2	606	5b5	17 Var.	2	Each 8'-8 to 46'-11	500	5b5	15 Var.	2	Each 8'-9 to 42'-8	407	5b5	13 Var.	2	Each 8'-10 to 38'-5	320				
Wingwall, F.F.V.	5c1	104 Var.	2	Each 2'-8 to 14'-8	940	5c1	96 Var.	2	Each 2'-8 to 13'-9	822	4c1	88 Var.	2	Each 2'-8 to 12'-9	453	4c1	80 Var.	2	Each 2'-8 to 11'-10	387	4c1	94 Var.	2	Each 2'-8 to 10'-9	421				
Wingwall, F.F.V.	5c2	50 Var.	2	Each 9'-1 to 14'-9	621	5c2	42 Var.	2	Each 9'-1 to 13'-10	502	4c2	32 Var.	2	Each 9'-1 to 12'-8	232	4c2	24 Var.	2	Each 9'-1 to 11'-9	167	c2	--	--	--	--				
Wingwall, F.F.V. (O)	5c3	2	2	15'-1	31	5c3	2	14'-1	29	4c3	2	13'-1	17	4c3	2	12'-1	16	4c3	2	11'-1	15	4c3	2	10'-1	13				
Wingwall, F.F.V. (A)	5c3	3	3	15'-1	47	5c3	3	14'-1	44	4c3	3	13'-1	26	4c3	3	12'-1	24	4c3	3	11'-1	22	4c3	3	10'-1	20				
Wingwall, B.F.V.	6c4	104 Var.	2	Each 6'-10 to 18'-10	2005	5c4	96 Var.	2	Each 6'-10 to 17'-11	1239	5c4	88 Var.	2	Each 6'-10 to 16'-11	1090	5c4	80 Var.	2	Each 6'-10 to 16'-0	953	5c4	70 Var.	2	Each 6'-10 to 14'-10	791				
Wingwall, B.F.V. (O)	6c5	1	1	19'-1	29	5c5	1	18'-1	19	5c5	1	17'-1	18	5c5	1	16'-1	17	5c5	1	15'-1	16	5c5	1	14'-1	15				
Wingwall, B.F.V. (A)	6c5	4	4	19'-1	115	5c5	4	18'-1	75	5c5	4	17'-1	71	5c5	4	16'-1	67	5c5	4	15'-1	63	5c5	4	14'-1	59				
Wingwall, B.F.V.	6c6	68	68	9'-0	919	6c6	60	9'-0	811	6c6	50	9'-0	676	6c6	42	9'-0	568	5c6	34	9'-0	319	5c6	26	9'-0	244				
Interior Wall, Both F.V	4c7	2	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5	4c7	2	3'-10	5				
Interior Wall, Both F.V	4c8	101 Var.	1	Each 1'-6 to 12'-3	464	4c8	93 Var.	1	Each 1'-6 to 11'-3	396	4c8	85 Var.	1	Each 1'-6 to 10'-4	336	4c8	76 Var.	1	Each 1'-6 to 9'-3	273	4c8	68 Var.	1	Each 1'-6 to 8'-4	223				
Interior Wall, Both F.V	4c9	2	2	12'-7	17	4c9	2	11'-7	15	4c9	2	10'-7	14	4c9	2	9'-7	13	4c9	2	8'-7	11	4c9	2	7'-7	10				
Apron, Longit., Bott.	4d1	26	26	55'-11	1013	4d1	26	51'-8	939	4d1	26	47'-6	867	4d1	26	43'-3	793	4d1	26	39'-0	677	4d1	26	34'-9	604				
Apron, Longit., Top	6f1	26	26	55'-11	2278	6f1	26	51'-8	2112	6f1	26	47'-6	1949	6f1	26	43'-3	1783	6f1	26	39'-0	1523	6f1	26	34'-9	1357				
Parapet, Vertical	4i1	51	51	7'-10	267	4i1	51	7'-10	267	4i1	49	7'-10	256	4i1	49	7'-10	256	4i1	49	7'-10	256	4i1	49	7'-10	256				
Parapet, Horiz.	7j1	4	4	37'-8	308	7j1	4	37'-8	308	7j1	4	37'-0	303	7j1	4	37'-0	303	7j1	4	37'-0	303	7j1	4	36'-7	299				
Apron, Trans., Top	6m1	82	2	27'-2	3346	6m1	73	27'-2	2979	6m1	65	26'-8	2603	5m1	57	26'-8	1585	5m1	48	26'-8	1335	5m1	40	26'-5	1102				
Apron, Trans., Top	6m2	48 Var.	2	Each 2'-3 to 25'-9	1009	6m2	48 Var.	2	Each 2'-6 to 26'-0	1027	6m2	48 Var.	2	Each 2'-0 to 25'-3	991	5m2	47 Var.	2	Each 2'-0 to 25'-3	674	5m2	48 Var.	2	Each 2'-0 to 25'-6	688				
Apron, Trans., Bott.	6m3	73	3	34'-6	3783	5m3	67	33'-8	2353	6m3	31	33'-9	1571	6m3	28	33'-9	1419	6m3	25	33'-9	1267	5m3	22	32'-8	750				
Curtain, Horiz.	6p1	6	6	37'-6	338	6p1	6	37'-6	338	6p1	6	36'-11	333	6p1	6	36'-11	333	6p1	6	36'-11	333	6p1	5	36'-8	275				
Wing Slope, Both F.	6s1	4	4	48'-4	305	6s1	4	43'-11	278	6s1	4	39'-7	238	6s1	4	35'-3	212	6s1	4	30'-10	185	6s1	4	26'-6	159				
Wing Slope, Both F. (O)	6s2	2	2	9'-5	28	6s2	2	9'-5	28	6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-7	29	6s2	2	9'-8	29				
Wing Slope, Both F. (A)	6s3	2	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31	6s3	2	10'-5	31				
Wing Slope, F.F.	6s4	2	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42	6s4	2	14'-1	42				
Wing Slope, F.F.	6s5	2	2	45'-10	145	6s5	2	41'-6	132	6s5	2	37'-2	112	6s5	2	32'-9	98	6s5	2	28'-5	85	6s5	2	24'-1	72				
Interior Wall, Both F.	6s6	2	2	56'-11	178	6s6	2	52'-7	165	6s6	2	48'-5	153	6s6	2	44'-0	139	6s6	2	39'-8	119	6s6	2	35'-5	106				
Curtain, Vert.	5t1	36	7	7'-11	297	5t1	36	7'-8	288	5t1	36	7'-5	278	5t1	36	7'-2	269	5t1	36	6'-11	260	5t1	36	6'-8	250				
Curtain, Vert, Ends	5t2	4	4	8'-4	35	5t2	4	8'-1	34	5t2	4	7'-10	33	5t2	4	7'-7	32	5t2	4	7'-4	31	5t2	4	7'-1	30				
Bracket, Vert.	5u1	4	4	6'-7	27	5u1	4	6'-5	27	5u1	4	6'-2	26	5u1	4	5'-11	25	5u1	4	5'-9	24	5u1	4	5'-6	23				
Estimated Quantities One Headwall	Reinf. Steel	20,815 LB				17,174 LB				14,320 LB				11,809 LB				10,109 LB				8423 LB							
	Concrete	42.4				121.2 CY				36.2				91.0 CY				21.0				71.2 CY				12.1			
		74.9				69.1				61.9				56.2				50.5				44.3				59.9 CY			

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. (A) - Indicates bar located at acute corner. (O) - Indicates bar located at obtuse corner. Refer to Sheet TWPWH 45-1-20 for acute and obtuse corner locations.

Headwall Notes:

- This headwall is based on a 3:1 slope normal to centerline of roadway.
- The sides of the apron are to be formed to ensure correct line and grade.
- All apron reinforcing steel is to be supported by bar chairs at intervals of not more than 3'-0" in either direction as outlined in the Standard Specifications.
- Clear distance from face of concrete to near reinforcing bar is to be 2" unless otherwise noted or shown. Clearance to the bottom ends of vertical bars shall be 3 inches.
- Concrete quantities are estimated from back of parapet.
- Horizontal tails of bars "b" & "s" estimated to extend 2'-5" beyond back of parapet (into end of barrel). Longitudinal bars "4d1" and "6f1" estimated to project into end section of barrel a minimum of 2'-5" beyond back of parapet. The "length" column reflects total number of feet necessary to meet these requirements.
- Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE	APPROVED BY BRIDGE ENGINEER	IOWA DOT Highway Division	
		Standard Design - Twin Reinforced Concrete Box Culverts	
		Parallel Wing Headwalls	
		July, 2020	
		Quantity Tabulation 12'-0" Span 45° Skew	TWPWH 45-7-20 Sheet 1 of 2